
# Astronomy Voyage

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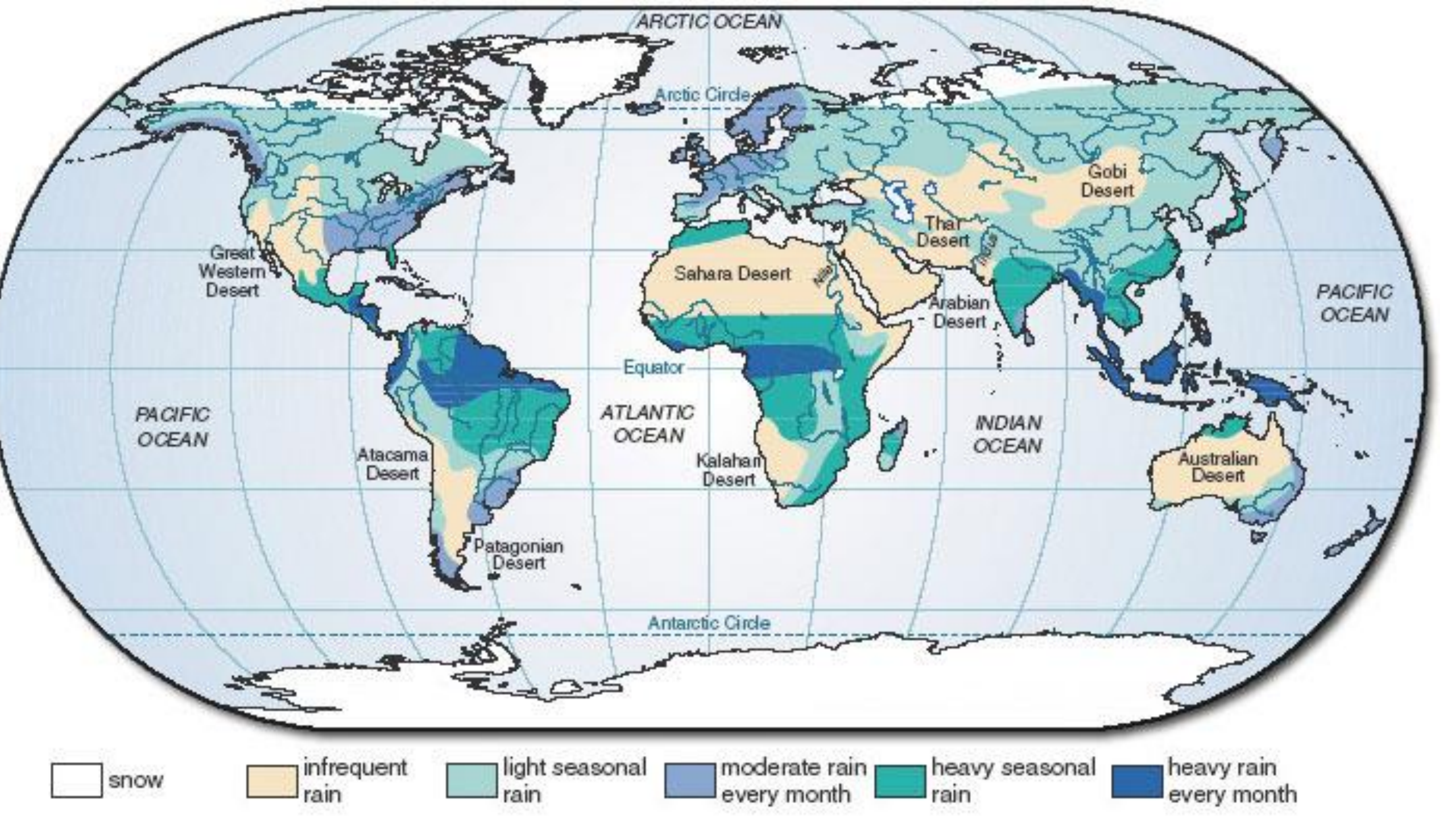
# Lecture Programme

- Tonight's Night Sky
- Astrophotography
- The Aurora
- The Scale of the Universe
- The birth & death of stars & galaxies
- The violent Universe
- **Modern Astronomy: Life as a Astronomer & Tools of the Trade**
- **Why We Are Here: A 13.8-billion year-old story**

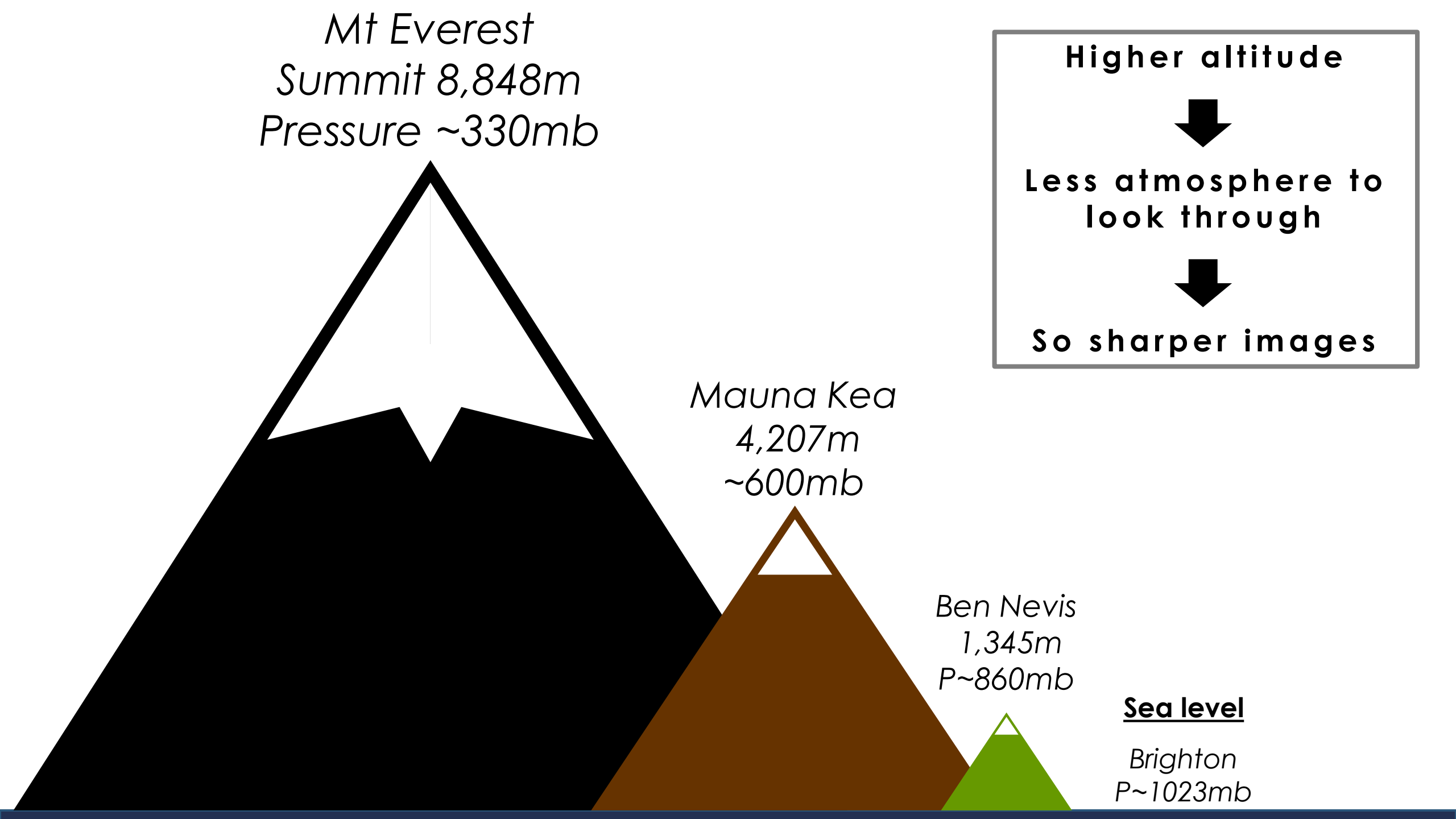

Royal Observatory,
Greenwich, London

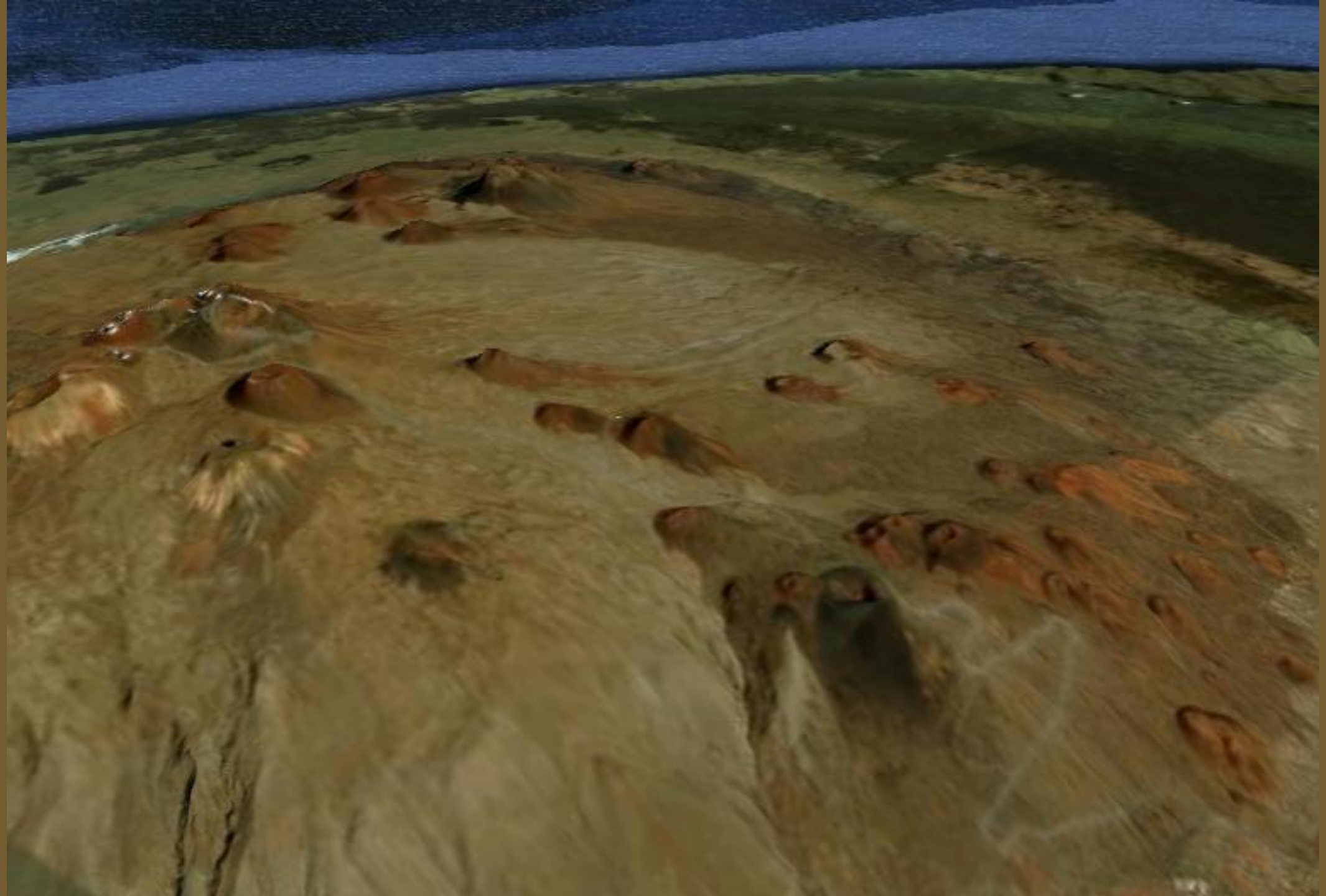
# Royal Observatory, Greenwich, London

# Royal Greenwich Observatory, Herstmonceux, Sussex


ARCTIC OCEAN
Arctic Circle
Great Western Desert
Gobi Desert
Thar Desert
Sahara Desert
Arabian Desert
PACIFIC OCEAN
Equator
PACIFIC OCEAN
ATLANTIC OCEAN
INDIAN OCEAN
Atacama Desert
Kalahari Desert
Australian Desert
Patagonian Desert
Antarctic Circle
snow
infrequent rain
light seasonal rain
moderate rain every month
heavy seasonal rain
heavy rain every month


Mauna Kea, Hawai'i


Mt Everest
Summit 8,848m
Pressure ~330mb
Higher altitude
Less atmosphere to look through
So sharper images
Mauna Kea
4,207m
~600mb
Ben Nevis
1,345m
P~860mb
Sea level
Brighton
P~1023mb



## MAJOR EMERGENCY
### High Altitude Sickness

***MAJOR SYMPTOMS***

Severe Unrelenting Sudden Headaches

Shortness of Breath

Chest Pain

Abdominal Pain

***MAJOR SIGNS***

Slurred Speech

Visual Disturbance

Loss of Coordination

Paralysis

Seizures

Collapse

Slow or Rapid Heart Beat

Labored Breathing

Unrelenting Nausea or Vomiting

## MINOR EMERGENCY
### High Altitude Sickness

***MINOR SYMPTOMS***

Mild shortness of breath

Dizziness

Lightheadedness

Headaches

Visual Change

Palpitations

Chest Tightness

Nausea

# MAUNA KEA HAZARDS

## EXPOSURE TO ALTITUDE

The summit elevation is 13,796 feet (4,205 m). The oxygen level is greatly reduced and a person can experience shortness of breath and/or impaired judgement. Reduced atmospheric pressure at high altitudes may cause **altitude sickness** or result in the development of other life threatening conditions such as **pulmonary edema** (fluid in the lungs) and **cerebral edema** (fluid on the brain). Also because the summit is above much of the atmosphere that blocks the sun's damaging ultraviolet rays, individuals risk exposure to serious sunburn and eye damage, especially if there is snow on the ground.

**Precautions Before Ascending the Summit**

- Prior to ascending the summit, acclimatize by spending at least 1/2 hour at the Visitor Information Station located at the 9,200 feet (2,804 m) elevation. This may lessen the intensity or onset of altitude sickness. If symptoms occur at this elevation, **do <u>not</u>** travel beyond the Visitor Information Station.
- Apply sunscreen and wear sunglasses and protective clothing.
- Hikers should register at the Visitor Information Station and use the buddy system.
- **DO <u>NOT</u> DRINK ALCOHOLIC BEVERAGES BEFORE OR DURING YOUR VISIT.**

**Persons at Risk**

It is strongly advised the following individuals <u>not</u> travel above the Visitor Information Station:

- Pregnant women
- Individuals with heart or respiratory problems
- Individuals in poor physical condition
- Children under the age of 16*

* Extended exposure to high altitudes could cause permanent damage to children whose bodies are still developing.

**Symptoms of ALTITUDE SICKNESS include:**

- Headaches
- Altered mental state
- Drowsiness
- Loss of balance
- Nausea
- Impaired reason

**Symptoms of PULMONARY EDEMA and CEREBRAL EDEMA include:**

- Severe headaches
- Blue lips or fingernails
- Vomiting
- Disorientation
- Breathing difficulties
- Extreme drowsiness (could result in a coma)
- Coughing

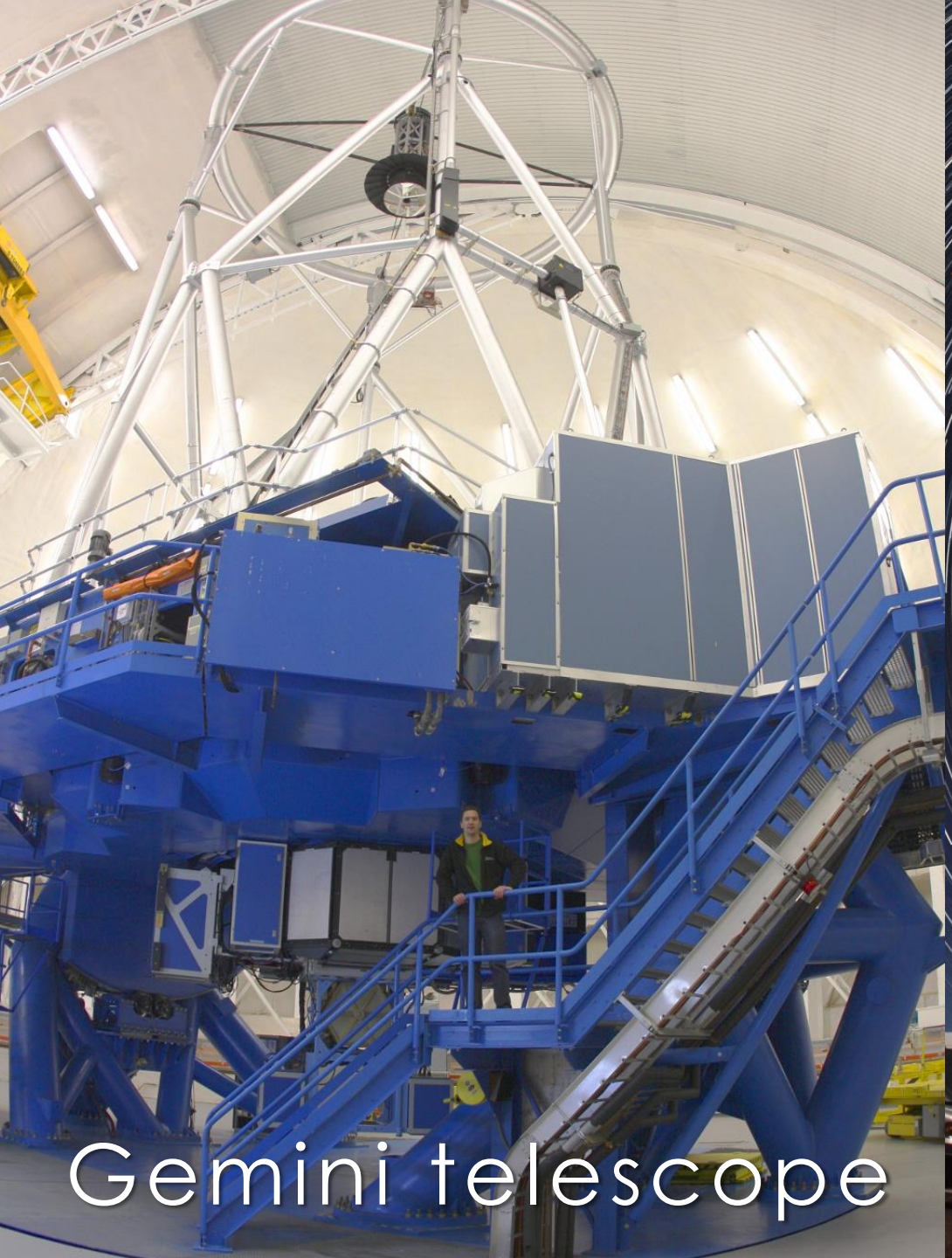
**IF SYMPTOMS PERSIST OR BECOME SEVERE,
IMMEDIATELY DESCEND TO A LOWER ELEVATION
IT COULD MEAN A MATTER OF LIFE OR DEATH!**

## SNOW RECREATION

Because some of the slopes are very steep with rock outcroppings at the bottom, you are strongly advised NOT TO USE the following: **inner tubes, boogie boards, or other devices that are NOT equipped with braking mechanisms or which do NOT provide directional control on snow or ice.**

Due to the fragile environment and cultural significance of Mauna Kea AND safety to you and others using the mountain, SNOW MOBILES OR ANY TYPE OF OFF-ROAD VEHICLES ARE PROHIBITED.

- **THERE IS NO EQUIPMENT OR INFRASTRUCTURE AVAILABLE FOR ORGANIZED SNOW PLAY ON MAUNA KEA**
- **ALL SNOW RECREATION IS AT THE RISK OF THE INDIVIDUAL**



# Gemini telescope

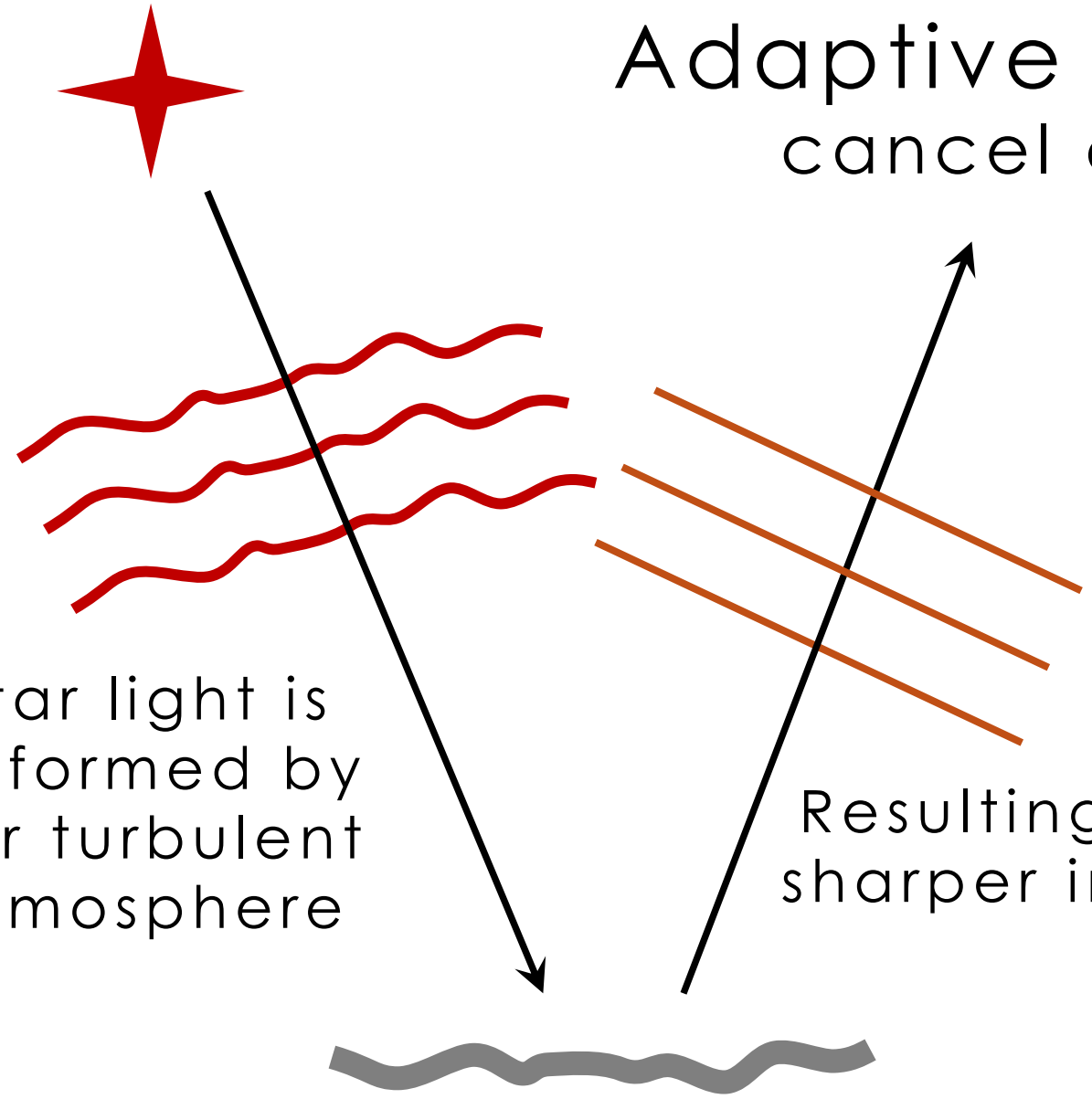
# Gran Telescopio, La Palma, 10.4m

XMM-Newton

Nordic Optical Telescope

# The Very Large Telescope
# Paranal, Atacama desert, Chile

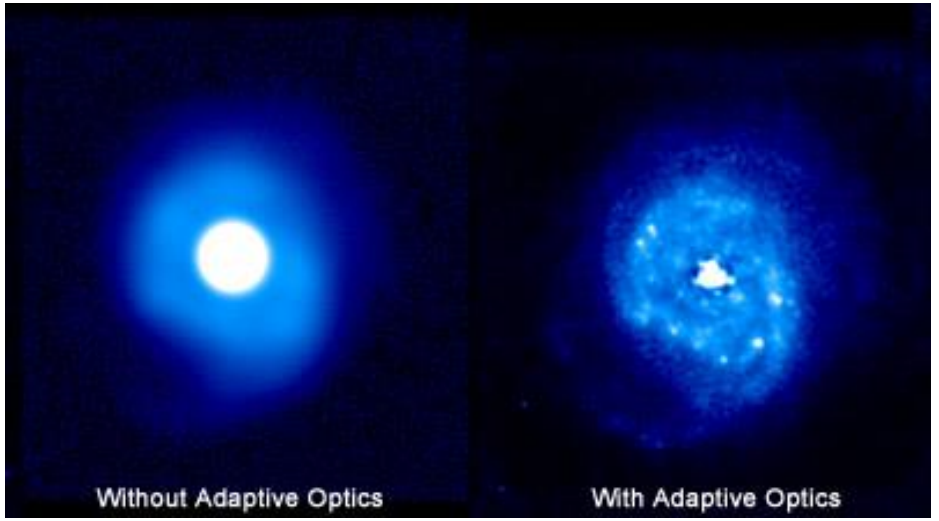
# Adaptive Optics - Flexible mirrors cancel out atmospheric distortions



Star light is deformed by our turbulent atmosphere

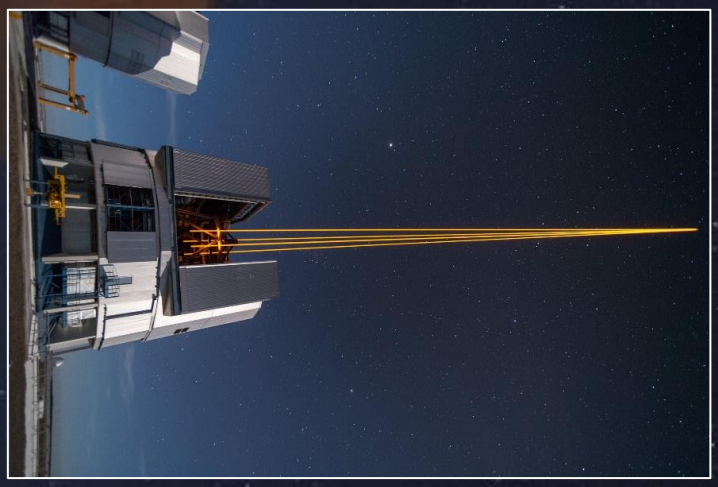
Resulting in a sharper image

The telescope mirror is deformed to cancel this out

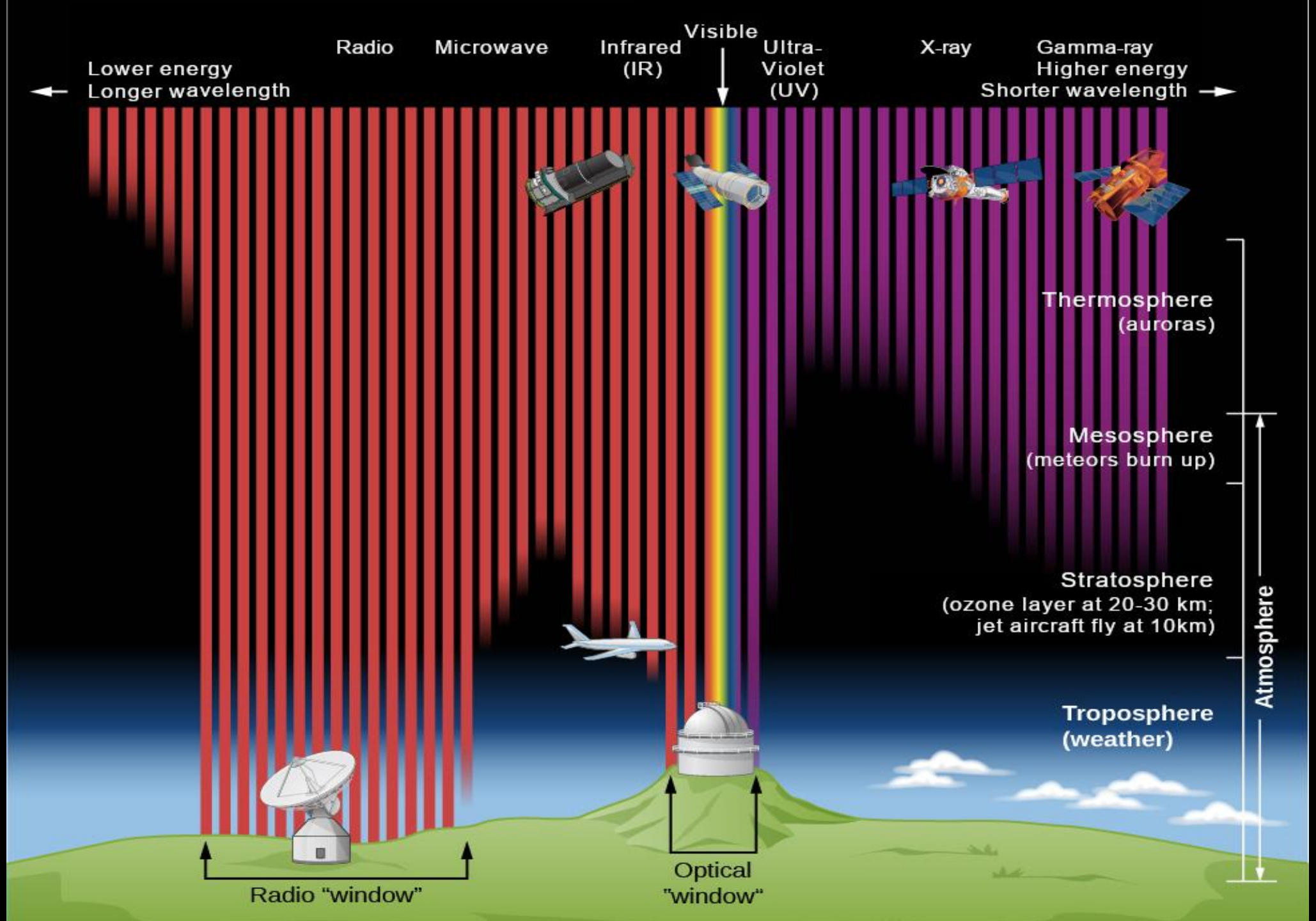



# ESO VLT

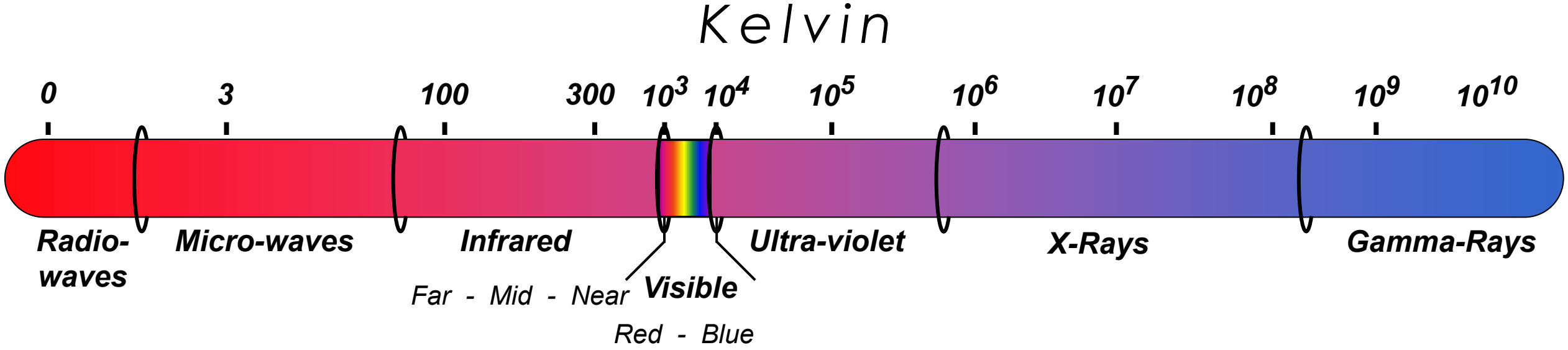
# Laser Guide star




Hubble Space Telescope


Radio
Microwave
Infrared (IR)
Visible
Ultra-Violet (UV)
X-ray
Gamma-ray
Lower energy
Longer wavelength
Higher energy
Shorter wavelength
Thermosphere
(auroras)
Mesosphere
(meteors burn up)
Stratosphere
(ozone layer at 20-30 km;
jet aircraft fly at 10km)
Troposphere
(weather)
Atmosphere
Radio "window"
Optical "window"

# Gas at different temperatures, emits light at different wavelengths.



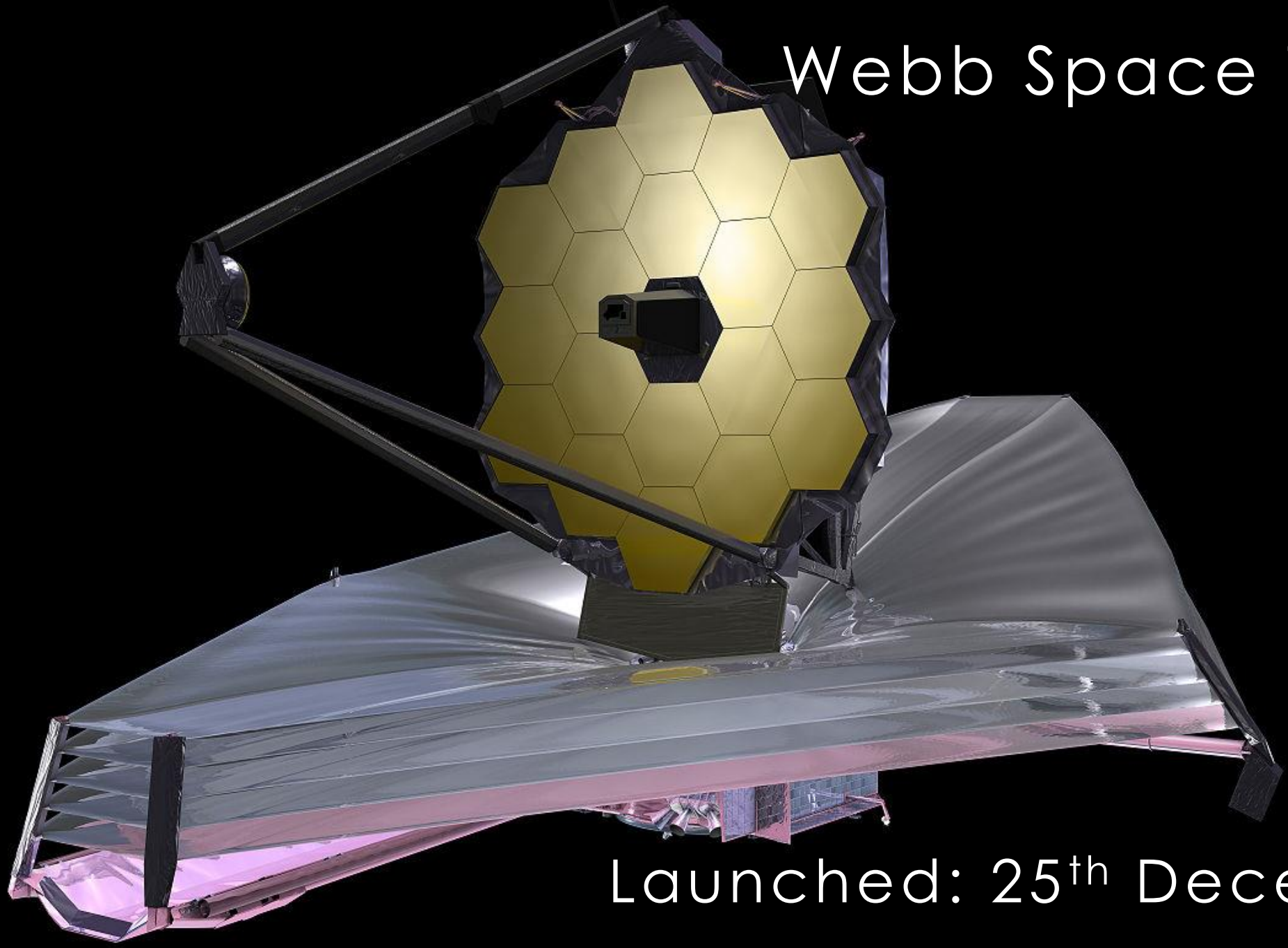

Radio waves originate from electrons in magnetic fields

1 Kelvin = 1° Celsius

But Kelvin scale starts at 0

Celsius starts at -273.15°

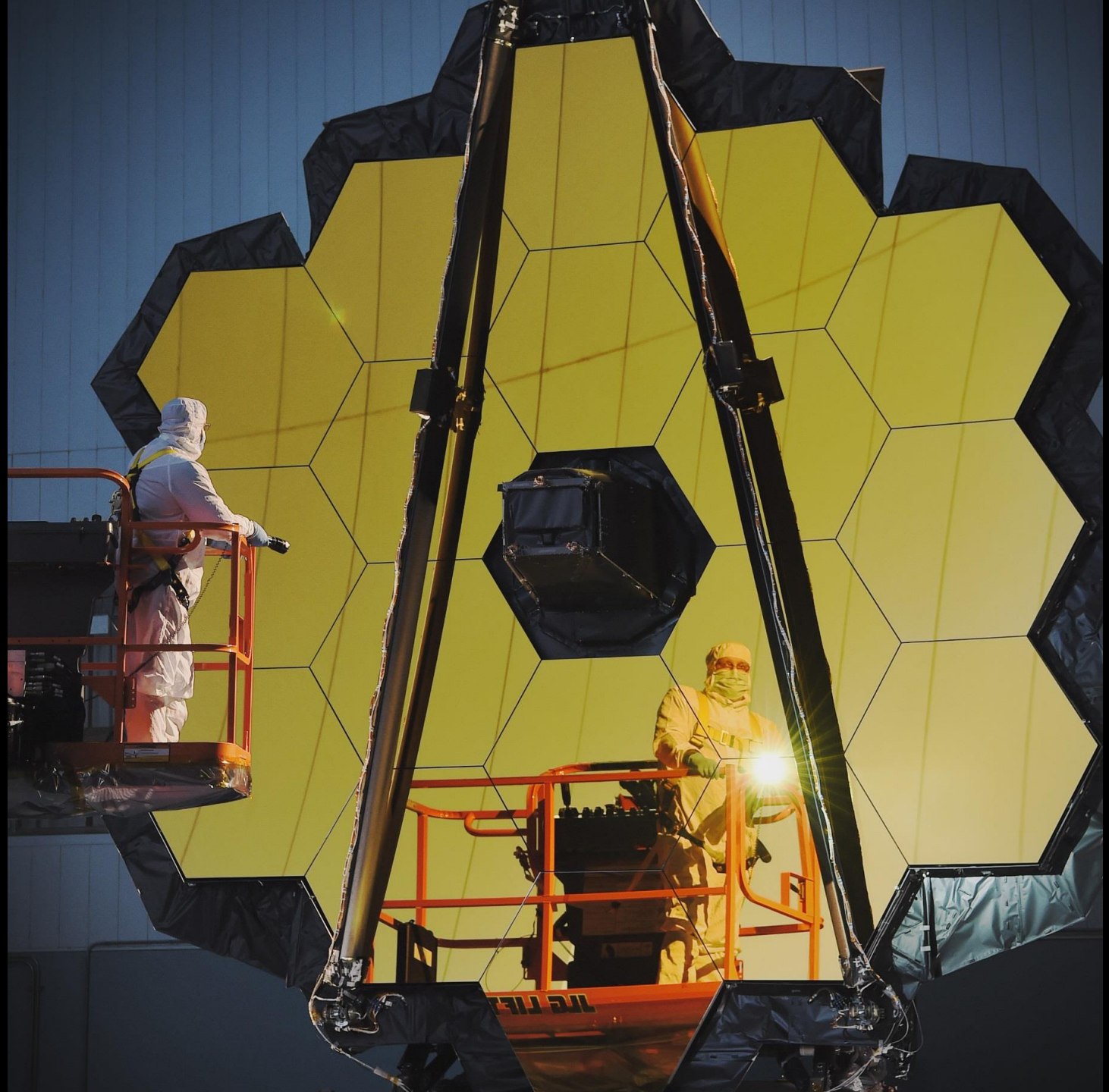
# Webb Space Telescope



Launched: 25th December 2021

# JWST

Consists of a 6.5m mirror made of 18 Segments, including the MIRI camera built in Scotland.



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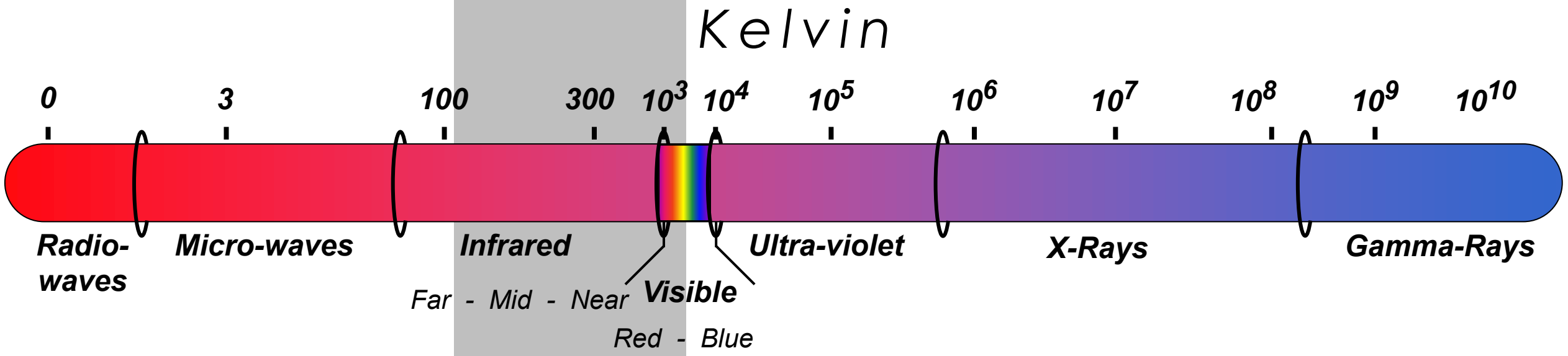

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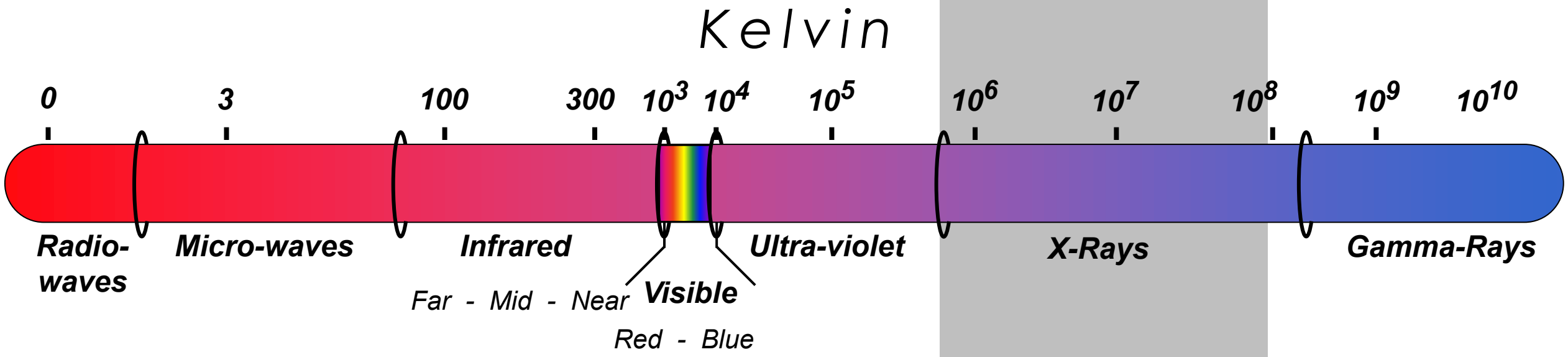
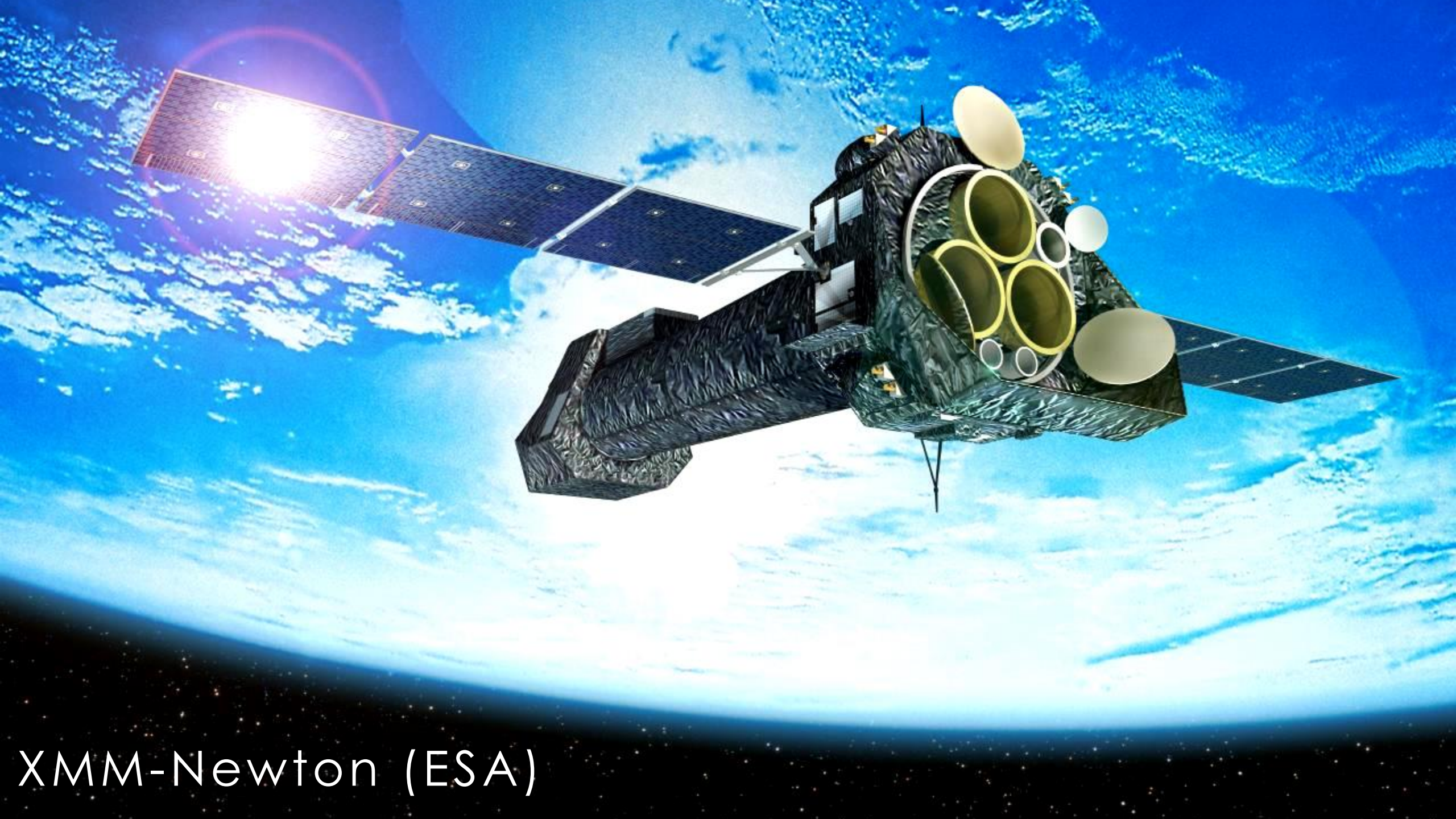


# Chandra (NASA)

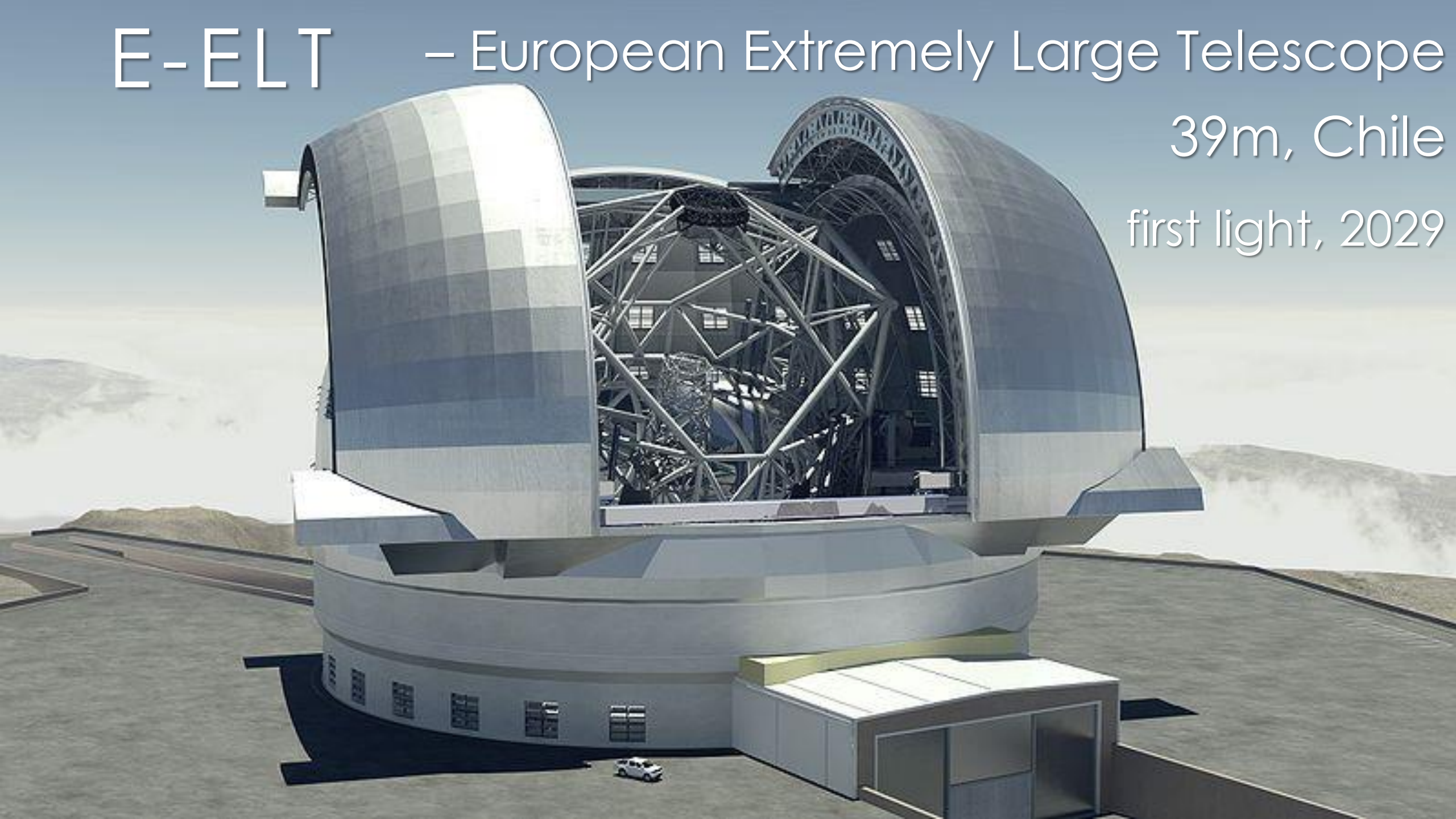


XMM-Newton (ESA)

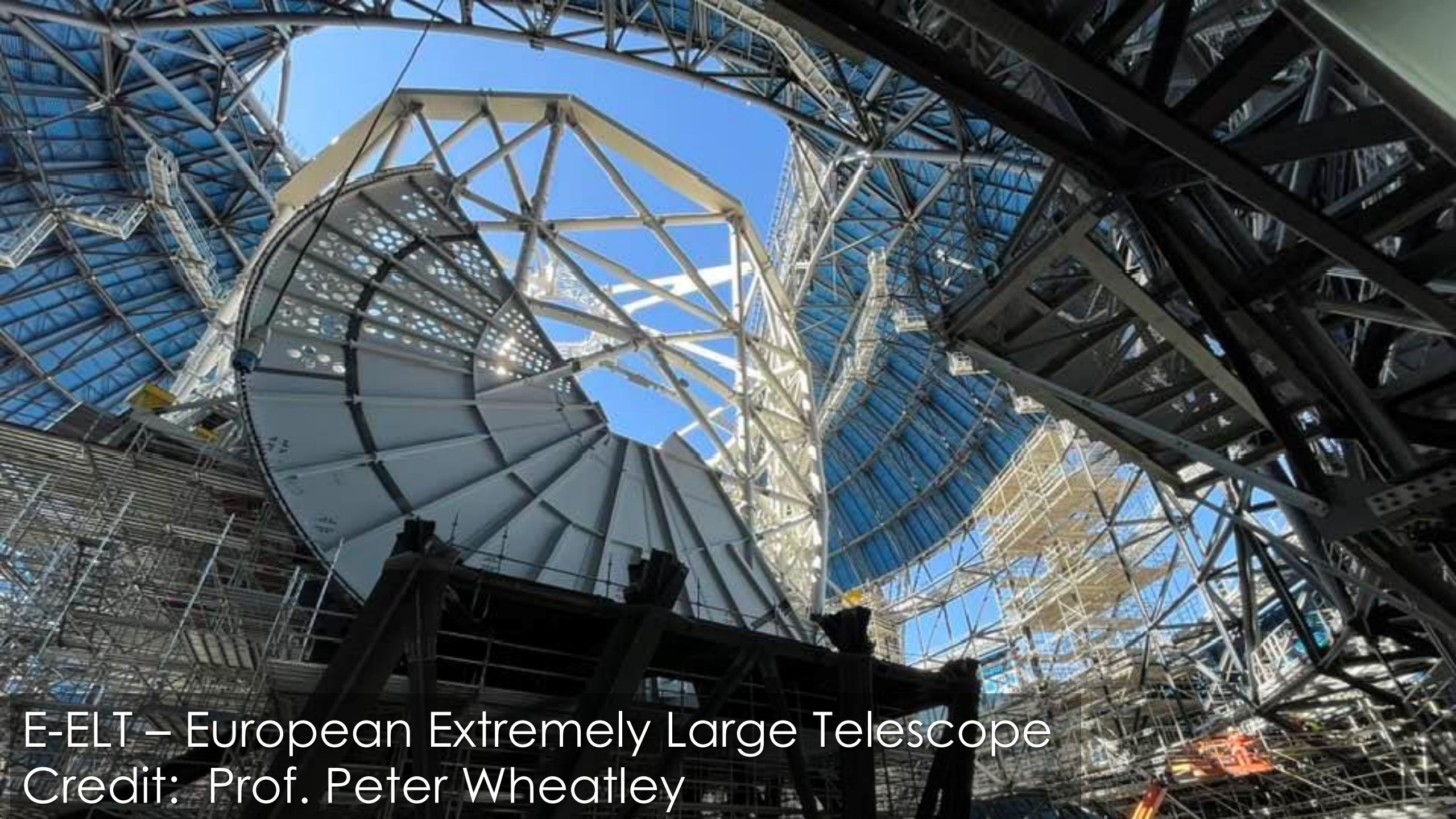
# E-ELT – European Extremely Large Telescope

39m, Chile

first light, 2029



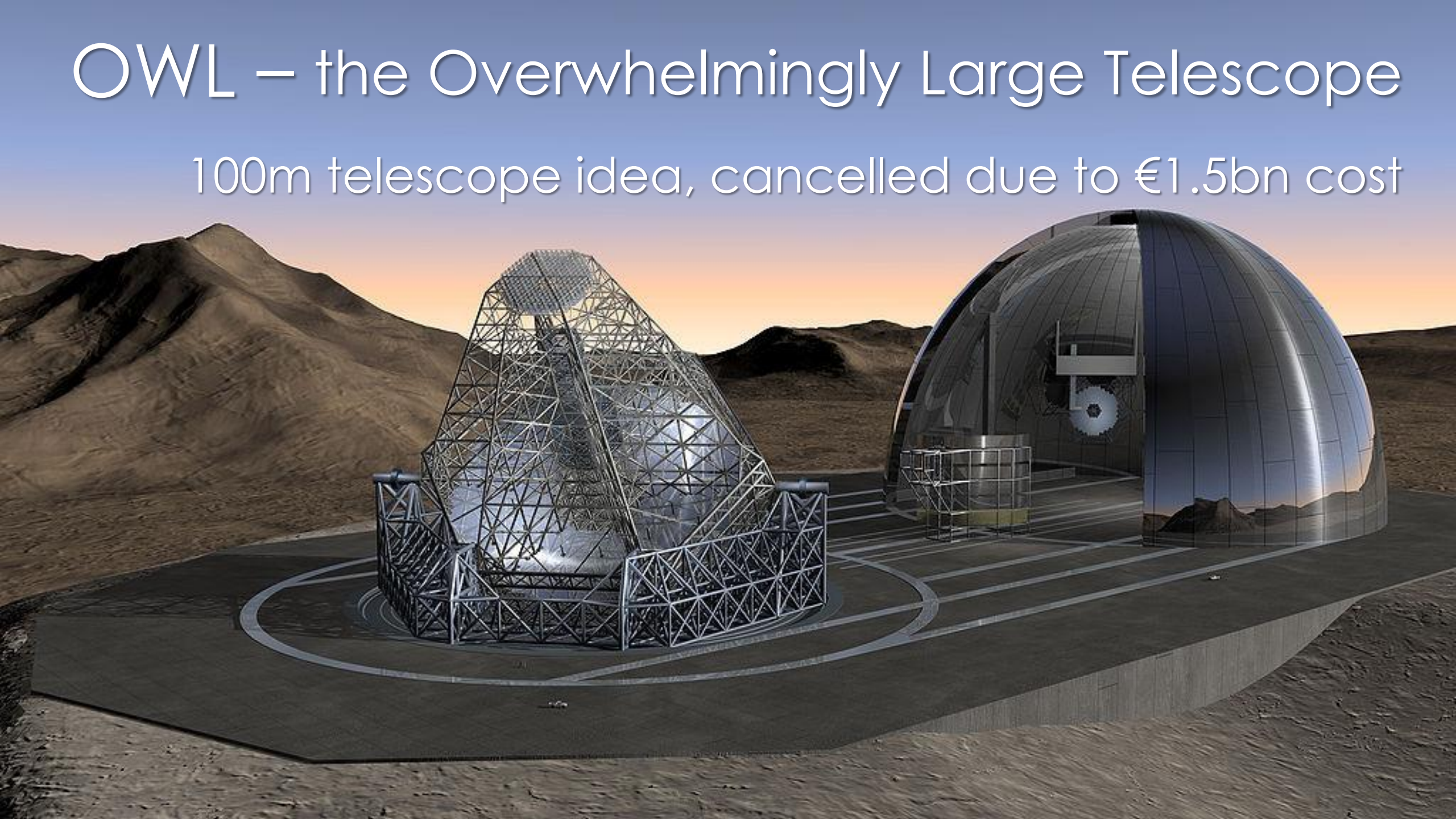

E-ELT – European Extremely Large Telescope



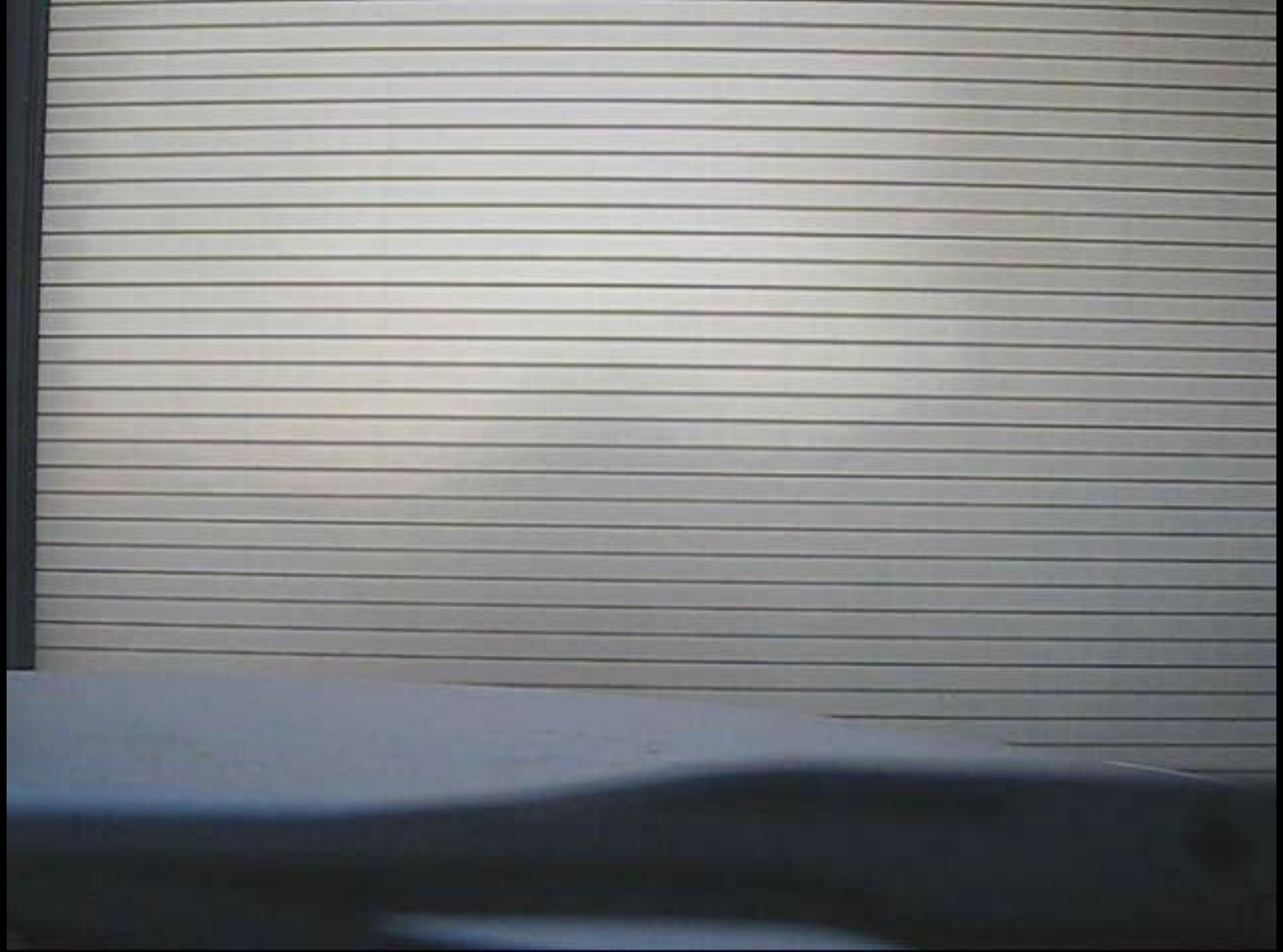
E-ELT – European Extremely Large Telescope
Credit:  Prof. Peter Wheatley

# OWL – the Overwhelmingly Large Telescope

100m telescope idea, cancelled due to €1.5bn cost




Gemini & UKIRT

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